

ABSTRACT  
PHOTOVOLTAIC DEVICE

5 A photovoltaic cell to convert low energy photons is described, consisting of a p-i-n  
diode with a strain-balanced multi-quantum-well system incorporated in the intrinsic  
region. The bandgap of the quantum wells is lower than that of the lattice-matched  
material, while the barriers have a much higher bandgap. Hence the absorption can be  
extended to longer wavelengths, while maintaining a low dark current as a result of  
10 the higher barriers. This leads to greatly improved conversion efficiencies,  
particularly for low energy photons from low temperature sources. This can be  
achieved by strain-balancing the quantum wells and barriers, where each individual  
layer is below the critical thickness and the strain is compensated by quantum wells  
and barriers being strained in opposite directions minimising the stress. The  
15 absorption can be further extended to longer wavelengths by introducing a strain-  
relaxed layer (virtual substrate) between the substrate and the active cell.

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